LOWER SARMATIAN FORAMINIFERA FROM MARGINAL MARINE ENVIRONMENTS IN THE MALACKY VICINITY (VIENNA BASIN)

Adriena Zlinská[1], Natália Hudáčková[2], Ivana Koubová[2]

[1]State Geological Institute of Dionýz Štúr, Mlynská dolina 1, 817 04 Bratislava, Slovak Republic; e-mail: adriena.zlinska@geology.sk

[2]Department of Geology and Palaeontology, Faculty of Science, Comenius University, Mlynská dolina, 842 15 Bratislava, Slovak Republic, e-mail: hudackova@fns.uniba.sk

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Abstract

V slovenskej časti Viedenskej panvy boli z vrtov situovaných v oblasti Malaciek, Perneka, Kuchyne a Stupavy študované sarmatské foraminifery (vrchný seraval – 12,7–11,6 mil. rokov). Z ílovitých a siltových sedimentov boli štandardnými laboratórnymi metódami získané spodnosarmatské foraminifery biozón Ammonia vienensis, Anomalinoides badenensis a veľkých elfídií s typickým druhom Elphidium reginum d´Orbigny.

Foraminifery boli podrobené štatistickým analýzam a sú typické pre plytkovodné prostredie.

Introduction

Area studied in the scope of this paper (Malacky surroundings) is situated in the mid west of the Slovakian part of the Vienna Basin, the area with the greatest density of oil wells (Fig. 1). In the paper there are presented results of the study of the Sarmatian (Upper Serravallian – 12,7 to 11,6 Ma), focused on its lower part. Material originate from the well cores MZ 93, MZ 34, MZ 68, MZ 26, MZ 55, M 1, MZ 87 drilled by Nafta a.s. oil company, the ZNV 11, ZNV 12 drilled by State Geological Institute of Dionýz Štúr and JV5, JV19, JV8, drilled by EQUIS Ltd. The studied wells are situated in the centre of mentioned area; in the Malacky town vicinity and two wells are situated on the Malé Karpaty foothill, near the Pernek village.

Methods

Standard laboratory methods were used for the fossil separation. Approximately 200 gr of the sediment for each sample were soaked in diluted hydrogen peroxide, washed under running water and wet sieved over the two sieves, which the upper one had meshes in 0,71 mm in diameter and the bottom one 0,071 mm. Foraminiferal tests were determinate under stereoscope microscope and scanned by SEM microscope for detail study of the test wall. For the paleoecological interpretations the dominance diagrams, equitability, counting of diversity indices (Simpson's, Fisher α) was used. The multidimensional statistical methods as Cluster analysis and PCA analysis were also employed. Statistical analysis were processed by computer programs Past, POLPAL and Statistica.

Results

The Sarmatian sediments in the studied area consists of clays, and silts with sandy layers, the sediments are sometimes bioturbated.

The studied sediments contained foraminiferal shells typical for Lower Sarmatian. One of the most abundant species was the leading one for the Lower Sarmatian, *Elphidium reginum* d´Orbigny accompanied by *Anomalinoides dividens* Lucz., *Articulina sarmatica* (Karrer) and *Sarmatiella moldaviensis* Bogd. as well. The assemblages here generally dominated by elphidiids and ammonias, which are opportunistic and generally live in sediment as epifaunal or infaunal dwellers (Murray 1991, Hayward et al. 1997). Based on statistical methods we could identify foraminiferal assemblages typical by dominance of species *Ammonia/Elphidium* (A/E), *Ammonia/Haynesina* (A/Hy), *Ammonia* (A), large elphidia (LE), *Anomalinoides badenensis/dividens* (Ab) and assemblage dominated by small miliolides (sM). The most conspicuous assemblages are those with highest dominance of *Ammonia* and *Elphidium* genera. The most dominant species herein, ammonias, are mostly detritivorous, living in eutrophic conditions, and sometimes even surviving short dysoxic events (Murray 2006). The elphidiids are herbivores but they may be in some cases detritivorous also. The elphidiids generally are characterized by two morphologies: some possess the peripheral keel, others have rounded peripheries. The first named are mostly herbivorous, epifaunal dwellers preferring sandy sediment, occurring in shallow marine environments with warm to temperate and normal to hypersaline (35–70 ‰) waters (Murray 2006). In the studied assemblages, the keeled morphotypes highly prevail in the lower parts of the studied well cores; the rounded elphidiids prevail in their upper parts. Other abundant species constitute almost all assemblage in some samples are thus from the genus *Anomalinoides*. The *Anomalinoides* presupposed the adaptation to the planktic or pseudoplanktic way of life, which requires a certain depth of water (Filipescu 2004). The last identified assemblage consists of small mi-

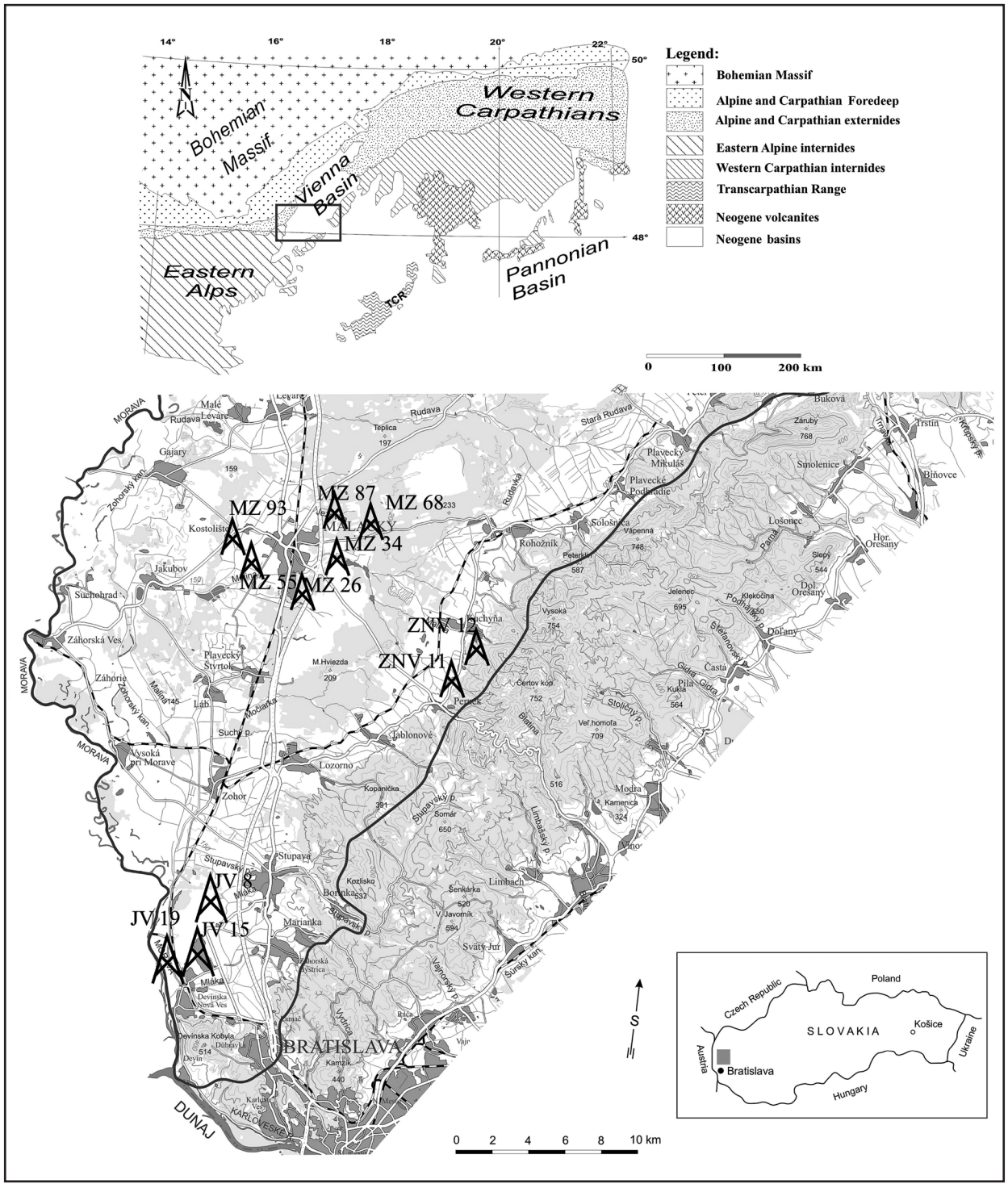

Fig. 1: Locality and positions of the studied wells.

liolide taxa, which obviously live in sandy to silty marginal environs, preferring climbing on algae and mostly tolerate hypersaline water (Gandhi 2004, Murray 2006).

In the sediment of various core depths we could identify foraminiferal zones following Grill (1941) concept:

Ammonia vienensis (impoverished zone) Zone proved in wells MZ 93 – (?1045, 1054 m), MZ 26 – (1053 m), MZ 87 (?1048,6–1032 m),

Ammonia vienensis Zone: MZ 93 (867,5–866,0 m), MZ 55 (867–856,33 m), MZ 87 ?1048,6 m, MZ 87 (864–857,1 m), MZ 26 (860,3–872,15 m),

Anomalinoides badenensis Zone: – MZ 93 (858–863,5 m), MZ 26 (859,9–856,4 m), MZ 26 (873,7–874,45 m).

Large elphidia Zone: MZ 93 (1032,6–1030,1 m), MZ 87 (1032–865,9 m), MZ 26 (1050,3–1045,3 m), MZ 26 (854,9–854,3 m), MZ 34 (1025–1031 m), MZ 34 (1031–1035 m), ZNV 11 (7,0–12,4m), ZNV 12 (1,5–2,9 m).

Conclusion and discussion

Foraminiferal associations of the biozones (Ammonia, Anomalinoides dividens and Elphidium reginum) identified in the sediments of the studied wells are typical

for the shallow water environment of the various salinities. Obviously those zones are linked to the stratigraphy, but in the studied material they are alternating, and more than stratigraphy, they mirror changes of the environmental factors. In the some parts of the cores, the association dominated by small miliolides occurs, more typical for the Middle/Upper Sarmatian. Nevertheless, we can suppose the Lower Sarmatian age of the studied sediments, on the basis of occurrence of *Elphidium reginum* d´Orbigny with the very rare presence of the younger elfidia as *Elphidium hauerinum* (d´Orb.).

The alternating foraminiferal assemblages of the lowermost Sarmatian: *Ammonia/Elphidium* (A/E) and *Ammonia/Haynesina* (A/Hy) document very shallow water lagoon of nearly marine salinity. The association of the large elphidia (LE) document deeper water, well aerated, meio – oligotrophic environs. In the more central part of the studied area, the deeper water area (more than 10 m) with sea floor probably covered by brown algae with oxygen deficit was documented. Those places were occupied by the foraminiferal oligoassociations of the genus *Anomalinoides* or by assemblages with its distinct predominance. Sediments here was developed in slightly deeper water enviroment, than those of large elphidia (LE) association. Association of *Ammonia*, occurring very often in the studied material, is probably a pioneering association in the area of water flooding, rich in nutrient supply in close succession with the appearance of representatives of the genus *Anomalinoides*.

Upper part of Lower Sarmatian sediments studied in the scope of this paper contain foraminiferal association with small miliolids (sM), typical for very shallow water environment (up to 1m depth) of normal marine, intermediate or hyper saline marshes overgrow with grass.

The associations of *Ammonia, Ammonia/Elphidium* and small miliolids are alternating in the marginal parts depending of the nutrient and water supply.

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